

Claims

[c1] A method for forming a transmission line structure for a semiconductor device, the method comprising:

- forming an interlevel dielectric layer over a first metallization level;
- removing a portion of said interlevel dielectric layer and forming a sacrificial material filled cavity within one or more voids created by the removal of said portion of said interlevel dielectric layer;
- forming a signal transmission line in a second metallization level formed over said interlevel dielectric layer, said signal transmission line being disposed over said sacrificial material;
- removing a portion of dielectric material included within said second metallization level so as to expose said sacrificial material, wherein a portion of said sacrificial material is exposed through a plurality of access holes formed through said signal transmission line; and
- removing said sacrificial material so as to create an air gap beneath said signal transmission line.

[c2] The method of claim 1, wherein said removing of said sacrificial material further results in a remaining support

structure beneath said signal transmission line, said support structure comprising material from said inter-level dielectric layer.

- [c3] The method of claim 2, wherein said support structure further comprises a continuous rail.
- [c4] The method of claim 2, wherein said support structure further comprises a plurality of individual posts.
- [c5] The method of claim 1, further comprising forming a ground plane within said first metallization level, said ground plane further comprising a back end of line metallic material completely encapsulated within a liner material.
- [c6] The method of claim 5, further comprising forming a pair of coplanar shielding lines adjacent said signal transmission line in said second metallization level.
- [c7] The method of claim 6, wherein said pair of coplanar shielding lines and said signal transmission line are also completely encapsulated with said liner material.
- [c8] The method of claim 6, further comprising forming vias in said interlevel dielectric layer for electrically connecting said pair of coplanar shielding lines and said ground plane.

- [c9] The method of claim 1, wherein said sacrificial material comprises an organic dielectric.
- [c10] The method of claim 9, wherein said sacrificial material is removed by a dry plasma etch.
- [c11] A back end of line transmission line structure for a semiconductor device, comprising:
 - an interlevel dielectric layer formed over a first metallization level;
 - one or more voids formed in said interlevel dielectric layer; and
 - a signal transmission line formed in a second metallization level, said signal transmission line being disposed over said one or more voids, said signal transmission line further comprising a plurality of access holes formed therethrough to provide removal access to a sacrificial material used to define said one or more voids; wherein said one or more voids define an air gap beneath said signal transmission line.
- [c12] The transmission line structure of claim 11, further comprising a support structure beneath said signal transmission line, said support structure comprising material from said interlevel dielectric layer.
- [c13] The transmission line structure of claim 12, wherein said

support structure further comprises a continuous rail.

- [c14] The transmission line structure of claim 12, wherein said support structure further comprises a plurality of individual posts.
- [c15] The transmission line structure of claim 11, further comprising a ground plane formed within the first metallization level, said ground plane further comprising a back end of line metallic material completely encapsulated within a liner material.
- [c16] The transmission line structure of claim 15, further comprising a pair of coplanar shielding lines adjacent said signal transmission line in said second metallization level.
- [c17] The transmission line structure of claim 16, wherein said pair of coplanar shielding lines and said signal transmission line are also completely encapsulated with said liner material.
- [c18] The transmission line structure of claim 16, further comprising vias formed in said interlevel dielectric layer for electrically connecting said pair of coplanar shielding lines and said ground plane.
- [c19] The transmission line structure of claim 11, wherein said

sacrificial material comprises an organic dielectric.

- [c20] A back end of line microstrip transmission line structure, comprising:
 - a signal transmission line formed on one metallization level;
 - a ground plane formed on another metallization level;
 - an air gap disposed between said signal transmission line and said ground plane, said air gap formed within an interlevel dielectric layer; and
 - one of said signal transmission line and said ground plane further comprising a plurality of access holes formed therethrough to provide removal access to a sacrificial material used to define said air gap.
- [c21] The microstrip transmission line structure of claim 20, further comprising a support structure beneath said one of said signal transmission line and said ground plane having a plurality of access holes, said support structure comprising material from said interlevel dielectric layer.
- [c22] The microstrip transmission line structure of claim 21, wherein said support structure further comprises a continuous rail.
- [c23] The microstrip transmission line structure of claim 22, wherein said support structure further comprises a plu-

rality of individual posts.

- [c24] The microstrip transmission line structure of claim 23, wherein said signal transmission line and said ground plane further comprise a back end of line metallic material completely encapsulated within a liner material.
- [c25] A back end of line coplanar waveguide transmission line structure, comprising:
 - a signal transmission line formed on a first metallization level;
 - a pair of coplanar shielding lines adjacent said signal transmission line in said first metallization level;
 - an air gap disposed beneath signal transmission line, said air gap formed within an interlevel dielectric layer;
 - and
 - said signal transmission line further comprising a plurality of access holes formed therethrough to provide removal access to a sacrificial material used to define said air gap.
- [c26] The coplanar waveguide transmission line structure of claim 25, further comprising a first ground plane formed on a second metallization level.
- [c27] The coplanar waveguide transmission line structure of claim 26, further comprising:

a second ground plane formed on a third metallization level;

said first metallization level disposed between said second metallization level and said third metallization level; and

both of said first and said second ground planes electrically connected to said pair of coplanar shielding lines.

- [c28] The coplanar waveguide transmission line structure of claim 25, further comprising a support structure beneath said signal transmission line, said support structure comprising material from said interlevel dielectric layer.
- [c29] The coplanar waveguide transmission line structure of claim 28, wherein said support structure further comprises a continuous rail.
- [c30] The coplanar waveguide transmission line structure of claim 28, wherein said support structure further comprises a plurality of individual posts.